DOCUMENT RESUME

ED 316 657 CE 054 237

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TITLE The FFA Chapter Activity Index: A Model for Measuring the Activity Level of an FFA Chapter.
PUB DATE 89
NOTE 11p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Agricultural Education; Higher Education; *Mathematical Models; *Measurement Techniques; Secondary Education; *Student Organizations; *Success
IDENTIFIERS *Future Farmers of America

ABSTRACT

This document describes a mathematical model designed to produce a weighted, standardized index that can be used to represent a statistically unbiased measure of a Future Farmers of America (FFA) chapter's level of activity in relation to other chapters in Ohio. The index, called the FFA Chapter Activity Index, is expected to be applicable to other states as well. The case for the new model is that the self-report instruments that have previously been used to collect data about the activity level of a chapter often produce biased or inaccurate information. The paper explains the model components and specifically how to compute the index by (1) calculating a weighted coefficient equal to the number of FFA members in the chapter divided by the number of instructors in the agricultural education department; (2) calculating a standardized score that represents the chapter members' state degree and district proficiency awards; (3) calculating a standardized score that represents the chapter's placing in the various agricultural skills contests; (4) calculating a standardized score that represents the chapter's participation in the various chapter awards programs; and (5) summing the three standardized scores and multiplying the result by the weighting coefficient. The mathematical model eliminates the reliability concerns raised by the older instruments; for example, if the same set of data is substituted into the model several times it always produces the same result. Good content validity as rated by a panel of experts is indicated. Two examples are given to explain the index, and the advantages of the index compared to the more common self-report method of assessing chapters' activities are discussed. Recommendations and six references conclude the document. (CML)

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The FFA Chapter Activity Index:

A Model for Measuring the Activity Level of an FFA Chapter

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Introduction

Researchers and practitioners in agricultural education are often involved with studies and activities involving the FFA Organization. One of the variables that is investigated is the activity level of an FFA chapter. The majority of the research involving the activity level of an FFA chapter use a self reporting instrument to gather the data. Swanson (1979) utilized an FFA Chapter Activity Record questionnaire to measure an FFA chapter's level of activity. Arrington (1981) modified the Swanson instrument to obtain the level of FFA chapter activity. Both of these instruments used self reporting as the measure of activity. When data are collected through this type of instrumentation, the possibility of receiving biased or inaccurate information is always present (Good, et.al., 1941).

Purpose

The purpose of this paper is to forward an index that will create an unbiased measure of an FFA Chapter's level of activity in relation to other chapters. The FFA Chapter Activity Index was developed as part of a study conducted by Christmas (1987). The mathematical model presented in this paper was originally based on secondary agricultural education programs that offered courses in either production or farm management taxonomies.

Model Components

The model components were selected based upon their unique scale of measurement and the generally accepted scoring procedures

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for chapter awards in the FFA. The items (raw scores) needed for the indexing procedure (FFA Chapter Activity Index) are:

- the number of secondary vocational agriculture instructors at the secondary school that are involved with the FFA chapter (I)
- the number of FFA members per chapter as listed on state records (M)
- the number of State FFA Degree recipients per chapter and the number of District Proficiency winners per chapter (SP)
- the placing of the chapter in state agricultural skill contests (SC)
- the chapter awards received in addition to the agricultural skill contests (CC)

An explanation of each model component follows.

WC

The first component of the FFA Chapter Activity Index is a weighting coefficient (WC) to account for the number of FFA members and the number of instructors in an agricultural education program. The weighting coefficient is calculated by dividing the number of members in the chapter (M) by the number of instructors (I) in the agricultural education department *[WC=M/I]*.

z scores

The remaining components of the model are based on *z* scores. "A *z* score indicates how many standard deviations an observation is from its mean" (Witte, 1985, p. 65). By performing *z* transformations on each raw score, we are able to standardize all observations. Mathematical transformations are then possible using these standardized scores. In the following example, a negative number is derived. To simplify future mathematical transformations, a constant of five is added to each calculated *z* score. The constant of five is an arbitrary number. Any number that will increase all calculated *z* scores above a negative value may be used.

For additional clarification the following example is presented. FFA Chapter "A" scored a total score on the state meats contest of 804. The

state mean for the meats contest is 999.6 and a standard deviation of 277.9. By substituting these values into the following formula

$$Z = \frac{X - \overline{X}}{S}$$

where X is the raw score of the chapter, and $\overline{X}$ and S are the mean and standard deviation for the distribution of chapter scores in the state contest, a *z* score for Chapter A's participation in the state meats contest is derived.

$$Z = \frac{804 - 999.6}{277.9}$$

$$= -\frac{195.6}{277.9}$$

$$= -.7039$$

Z_{sp}

The second component of the FFA Chapter Activity Index is the calculation of a standardized score representing a chapter's individual members accomplishments. *Z* scores are calculated for the number of State FFA Degree recipients and the number of District Proficiency Award winners in each chapter. A total standardized score (Z_{sp}) is arrived at by adding the weighted *z* score for the number of State FFA Degree recipients and the weighted *z* score for the number of District Proficiency Award winners in each chapter.

Z_{sc}

The third component of the activity index is the creation of a standardized score representing the chapter's placing in the various agricultural skills contests (these contest scores are interval data). In contest(s) where individuals compete, the scores of the individuals from the same chapter are averaged and recorded as a mean score for that FFA Chapter. A *z* score is calculated for each skill contest the chapter participated in. The resulting weighted *z* scores are added to create a total standardized score (Z_{sc}) representing the chapter's level of activity in state sponsored skills contests.

Z_{cc}

The final component of the FFA Chapter Activity Index is a standardized score representing the chapter's participation in the various Chapter Awards programs offering an award scheme of Gold, Silver, Bronze or Honorable Mention. These contests are Parliamentary Procedure, Building Our American Communities (BOAC), Secretary's Book, Treasurer's Book, Reporter's Book, Creed Speaking, Beginning Speaking, Extemporaneous Speaking and Prepared Speaking. All award categories are coded as follows: Gold=4, Silver=3, Bronze=2, Honorable Mention=1 and no award=0. The Chapter Contest has an award scheme of Gold Medal Chapter or Superior Chapter. The Gold Medal Chapters are coded two, Superior Chapters are coded a one and chapters with no award receive a zero. The resulting *z* scores are summed, creating a total standardized score (Z_{cc}) representing the chapter's level of activity in the Chapter Awards program.

The final index consists of summing the three groups of standardized scores and then multiplying the resulting figure by the weighting coefficient. Represented in terms of a mathematical model we have:

$$\text{FFA Chapter Activity Index} = WC\ (Z_{sp}+Z_{sc}+Z_{cc})$$

The resulting product of these operations yield a weighted, standardized number that can be used to represent a statistically unbiased measure of an FFA chapter's level of activity.

Reliability

Previous instruments have relied upon respondents to provide requested information. A self reporting instrument raises reliability and validity concerns. The mathematical model proposed in this paper eliminates the instrument reliability problems. When using a mathematical model as a measuring instrument, the reliability of the instrument is not a concern. If the same set of data is substituted into the mathematical model several different times, the results each time will be identical. Although measurement error (systematic and

random) will be present in any product of the model, error is not a function of the instrument but rather a function of the data being used in the model.

Validity

The question that Kerlinger (1985, p. 417) uses to express one definition of content validity asks "Is the substance or content of this measure representative of the content or the universe of content of the property being measured?" He further states that "Content validation consists essentially in judgement. Alone or with others, one judges the representativeness of the items" (p. 418).

To establish the content validity of this instrument a panel of experts composed of teacher educators in agricultural education, graduate students majoring in vocational and agricultural education, and practicing agricultural education instructors reviewed the instrument. The panel indicated that the FFA Chapter Activity Index had sufficient content validity when used to measure an FFA chapter's level of activity with concern to recognition programs at the area, district, state or national level.

Example of Calculating the FFA Chapter Activity Index

To provide further clarity to the FFA Chapter Activity Index, two abbreviated examples are presented. Located in Table 1 are the raw data needed for calculating the weighting coefficient. The rationale for this weighting coefficient is to compensate for the number of instructors and members in a program. In other words, those programs that have multiple instructors should have more members and be able to compete in more recognition programs than programs with a lesser number of instructors.

Table 1
FFA Membership and Number of Instructors

Chapter	No. of FFA Members	No. of Instructors	Weighting Coefficient
A	53	1	53
B	126	3	42

In Table 2 are the raw data needed to calculate the second component (Z_{sp}) of the FFA Chapter Activity Index. *Z* score transformations have already been performed in order to simplify the example. The weighting factor of five is shown in brackets. By summing the transformed *z* scores, a figure that represents the activeness of the individual members toward an advanced degree and/or accomplishment in one of the proficiency award areas is derived.

Table 2
***Z* Scores for State FFA Degree Recipients and District Proficiency Winners**

Chapter	No. of State FFA Degrees	No. of District Proficiency Winners	Z_{sp}
A	.3997 [+5]	1.7417 [+5]	12.1414
B	-.1076 [+5]	.5399 [+5]	10.4323

The component used to measure the activity of the chapters' involvement in the state sponsored agricultural skills contest (Z_{sc}) is displayed in Table 3. A few of the contests used in the original model and their corresponding *z* scores are listed for the purpose of this example. The researcher desiring to utilize this model would include all of the skills contests that would be appropriate for their specific study.

Table 3
Z Scores for Agricultural Skills Contests

Chapter	Agricultural Mechanics	Farm Management	Livestock	Meat	Z_{sc}
A	(Did not compete)	-.5174 [+5]	.7772 [+5]	-.7039 [+5]	14.5559
B	-.3044 [+5]	-.5174 [+5]	.4988 [+5]	1.5874 [+5]	21.2644

The final component (Z_{cc}) of the FFA Chapter Activity Index model is the standardized scores representing the chapter's level of activity in Chapter Contest Awards (Table 4). As in Table 3, only a few standardized scores are presented, the weighting constants are in brackets and the total *z* score for that component is listed.

Table 4
Z Scores for Chapter Contests

Chapter	Chapter Contest	Parliamentary Procedure	BOAC	Prepared Speaking	Z_{cc}
A	1.2634 [+5]	.0397 [+5]	1.5714 [+5]	.2575 [+5]	23.1321
B	-.0281 [+5]	-.8739 [+5]	-.4648 [+5]	1.3857 [+5]	20.0189

The final step in arriving at the FFA Chapter Activity Index score for chapter A and chapter B is substituting the appropriate numbers for each component of the model.

FFA Chapter Activity Index = WC ($Z_{sp}+Z_{sc}+Z_{cc}$)

Chapter A Index Number = 53 (12.1414 + 14.5559 + 23.1321)
= 53 (49.8294)
= 2640.9582
= 2641

Chapter B Index Number = 42 (10.4323 + 21.2644 + 20.0189)
= 42 (51.7156)
= 2172.0552
= 2172

The interpretation for the above calculated index scores indicates that Chapter A is more active than Chapter B. More specifically, Chapter A is 468.903 *z* score units more active than Chapter B. If the large numbers are bothersome for the researcher, the index score may be transformed into a smaller set of numbers through dividing by a constant (e.g., 2641 / 1000 = 2.641 or 2.6).

Discussion

Although this index was developed for use in Ohio, other states and the National FFA Organization would find this model useful. The localization of the model to a state, area, or region may be accomplished by including within each group of standardized scores those activities or events common to their FFA recognition programs.

Researchers who wish to include the activity level of an FFA chapter as one of the variables being investigated will find this model to have many advantages. Among these advantages are:

- The resulting index number generated by the model is a statistically unbiased, highly reliable and valid measure of an FFA chapter's level of activity when compared to other chapters.
- The standardized index score allows the researcher to compare, on an equal basis, one chapter to another using variables of different scales of measurement (nominal, ordinal, and interval data).
- The model provides the opportunity to expand ex post facto and historical research. The raw data used in the model are usually available from previous years activities. Through record analysis, researchers will be able to obtain data relating to a chapters level of activity during past years.
- Development of and continued support of a database containing data needed for the model would serve as a resource for future research efforts.
- Through utilization of the above mentioned database, chapter advisors, state supervisory staff and teacher educators would be able to determine how well a chapter has performed compared to previous years performance or compared to other chapters.

- The index is easily utilized with the use of existing statistical analysis software.
- The use of the index is inexpensive when compared to alternative methods of collecting similar information.
- The index could be used to measure the construct of chapter quality, especially pertaining to the recognition programs. Although this is not the major intent of the model, conventional wisdom would indicate that the higher the placing of a chapter in a recognition program (e.g., skill contest, BOAC, or proficiency award) the higher the quality of work and/or training.

Recommendations

It is recommended that the National FFA Organization and state FFA associations develop a database containing the raw data needed for use with the FFA Chapter Activity Index. State departments of education, universities and colleges, and local agricultural education programs need to collaborate in the development of this database.

Future research is recommended to validate the extent to which the FFA Chapter Activity Index measures the "quality" construct of an FFA chapter. Investigations of this nature should not only look at the quality of the chapters' participation in recognition programs but also at the use of the index as a predictor of overall FFA chapter activity.

Preservice and inservice activities should provide instruction in the mathematical transformations that form the basis of the model and how chapter advisors may utilize the FFA Chapter Activity Index.

Studies involving self reporting instruments measuring the level of activity of an FFA chapter should include one or more of the index components (Z_{sp}, Z_{sc} or Z_{cc}). Correlations between responses and the index components could be used as a measure of the accuracy of the responses.

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